Mathletics

Series D Student

Geometry

My name

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Series D – Geometry

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Series D – Geometry

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Series Author:

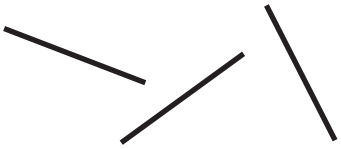
Nicola Herringer

Lines and angles – vertical, horizontal and diagonal lines

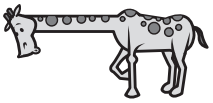
Vertical lines go straight up and down.

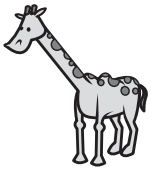
Horizontal lines go straight across.

Diagonal lines go on a slant.



1 ✓ **any vertical necks.** ◯ **any horizontal necks.** ✗ **any diagonal necks.**





2 **How many lines are on these shapes?**

a

vertical ☐

horizontal ☐

diagonal ☐

b

vertical ☐

horizontal ☐

diagonal ☐

c

vertical ☐

horizontal ☐

diagonal ☐

Shapes can be made up of straight lines, curves, or a mixture of both.

3 **Draw a shape that is made up of:**

a straight lines

b a curve

c a mixture of lines

Lines and angles – vertical, horizontal and diagonal lines

4 **Solve these problems:**

a Look at these letters. Let's explore their shapes and the lines that make them.

A B C D E F G H I J K L M

N O P Q R S T U V W X Y Z

b These 2 letters belong together in a group. **P D**
Which other letters do you think belong in the same group?
Record them and explain to your partner why.

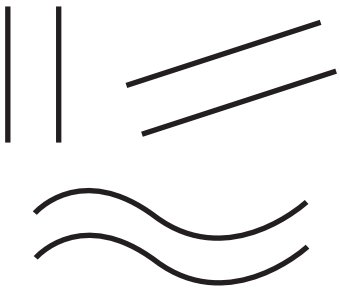
c These 2 letters belong together in a group. **T Y**
Which other letters belong in the group?
Record them and explain to your partner why.

d These letters form a group. **A Q R N M V W X**
Can you see why? Record your thinking here.

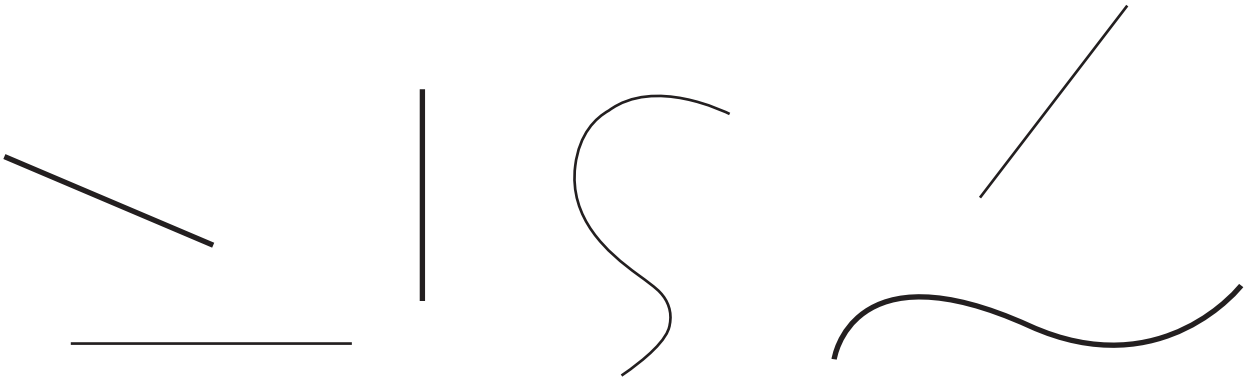
Lines and angles – parallel lines

Parallel lines are always the same distance from each other and can never meet. They can be any length and go in any direction.

Curves can also run parallel to each other.

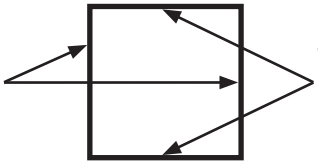


1 **Draw lines or curves parallel to each of these.**



Shapes can have parallel lines.

Look at this **square**.



A square has 2 sets of parallel lines.

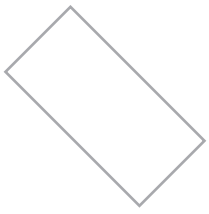
2 **Trace any parallel lines in matching colours. Finish the statements.**

a 

A square has _____ sets of parallel lines.

b 

A triangle has _____ sets of parallel lines.

c 

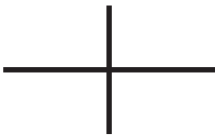
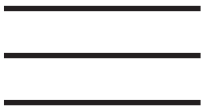
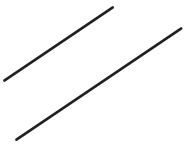
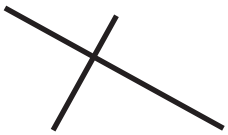
A rectangle has _____ sets of parallel lines.

d 

A regular hexagon has _____ sets of parallel lines.

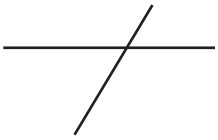
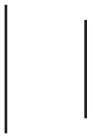
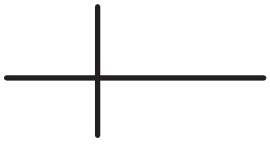
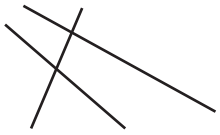
Lines and angles – parallel and perpendicular lines

1 **Look at each group of lines. Tick the parallel lines.**

a  ☐	b  ☐	c  ☐
d  ☐	e  ☐	f  ☐

Perpendicular lines meet at right angles. Sometimes they intersect (cross over), sometimes they do not intersect.

2 **Look at each group of lines. Tick the perpendicular lines.**

a  ☐	b  ☐	c  ☐
d  ☐	e  ☐	f  ☐

3 **List the first 10 letters of the alphabet in capitals. Circle the letters that have either parallel or perpendicular lines.**

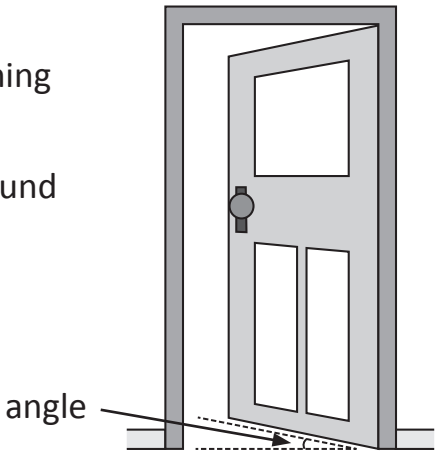
_____

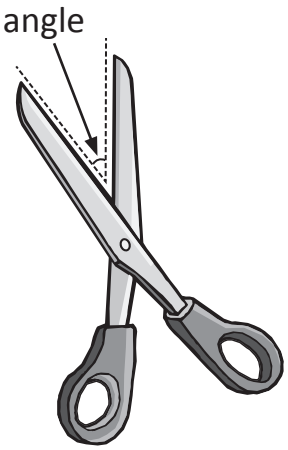
Lines and angles – angles

An angle is the amount of turning between two lines that meet.

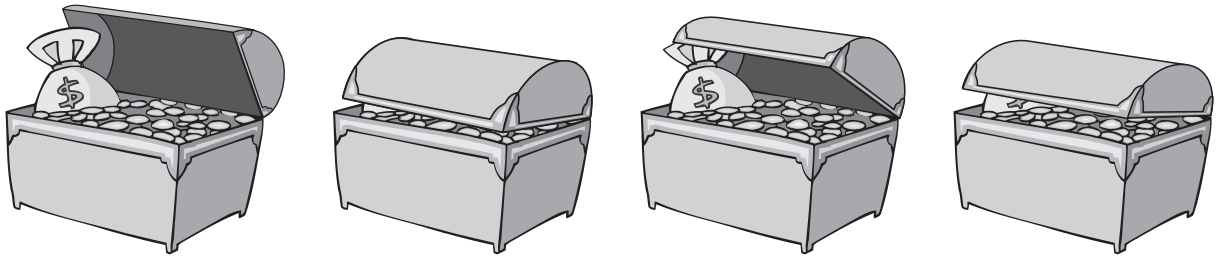
There are lots of angles all around us. You have probably noticed many already.

Here are two examples of angles in your classroom:





1 **Look at the angle on each open chest lid. Trace the angle and then order the treasure chests' lids from the smallest to largest angle.**



2 **Follow the directions about angles.**

a Tick the pair of scissors that has the largest angle.

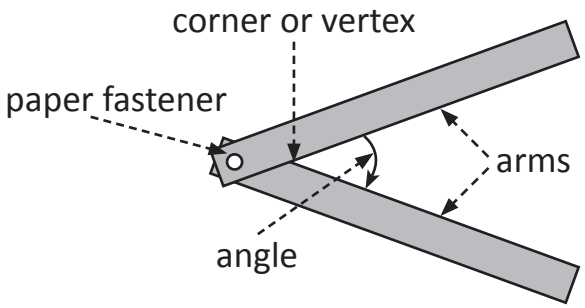
b Place a circle around the pair of scissors that has the smallest angle.

c Find something in your classroom the has an angle larger than anything on this page and draw it below:

Lines and angles – angles

If an angle is smaller than a right angle, it is called an **acute** angle; if it is larger it is known as an **obtuse** angle.

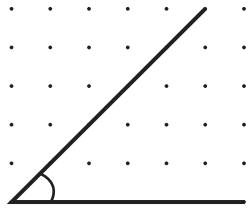
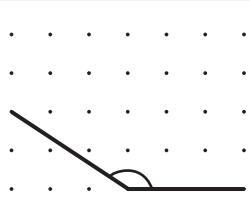
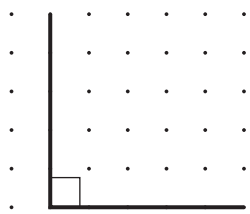
Make an angle tester with two straight pieces of cardboard joined with a paper fastener.



3 **Use your angle tester to measure and compare these angles. Order them smallest to largest by writing 1 to 4 in the box. Write whether each is an acute, obtuse or right angle.**

a ☐ _____ **b** ☐ _____ **c** ☐ _____ **d** ☐ _____

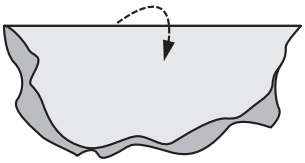
4 **For this activity you will need a ruler and a sharp pencil. Follow the directions for each angle.**

		Copy the angle	Draw a smaller angle	Draw a larger angle
a				
b				
c				

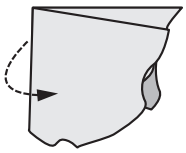
Lines and angles – angles

A right angle is an angle where two lines meet at a square corner.

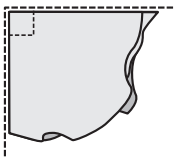
Make a right angle tester by folding a piece of paper like this:



Step 1: Fold a piece of paper in half.

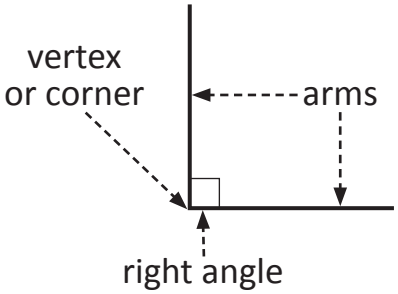


Step 2: Fold the same piece of paper in half again.

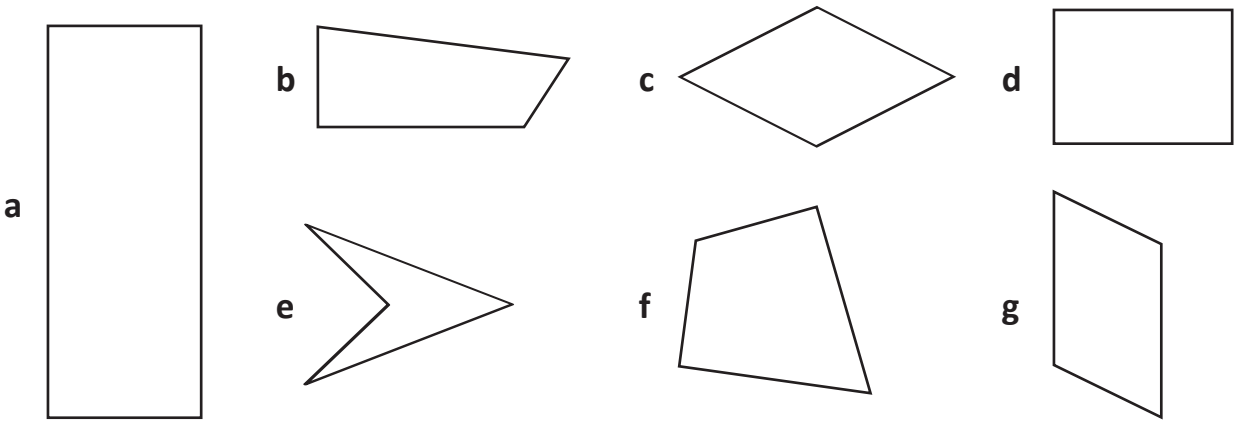


Step 3: Make sure that the creases are pressed down firmly.

You have made the corner of a square which is a right angle. A right angle is 90 degrees (90°).



5 **For each shape, circle the corners that are right angles. Write the number of right angles inside each shape.**



6 **Find some right angles in your classroom and list them here:**

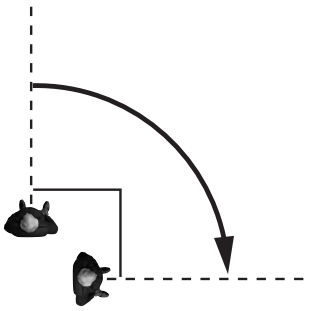
_____

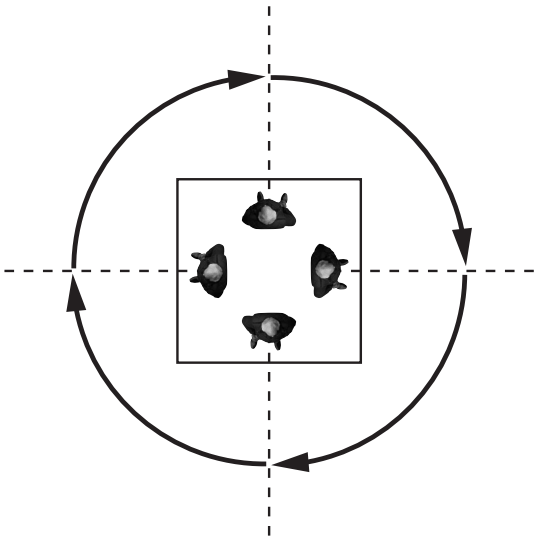
_____

_____

Lines and angles – right angles in turns

People and objects can make turns. This person has just made a quarter turn. A quarter turn is a right angle.



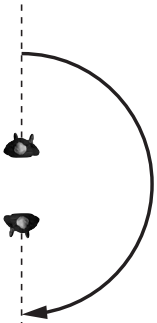


If you make two quarter turns, you will have turned through two right angles and made a half turn. You will be facing in the opposite direction to how you started.

Turn another right angle and you'll have made a three-quarter turn and you'll have made a whole turn and be back where you started.

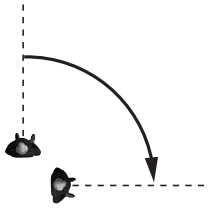
1 **How many right angles has each person turned? How much of a turn have they made?**

a



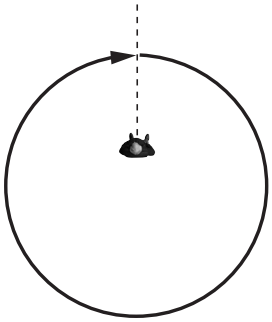
☐ right angles = ☐ turn

b



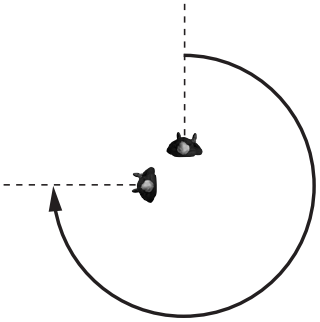
☐ right angle = ☐ turn

c



☐ right angles = ☐ turn

d

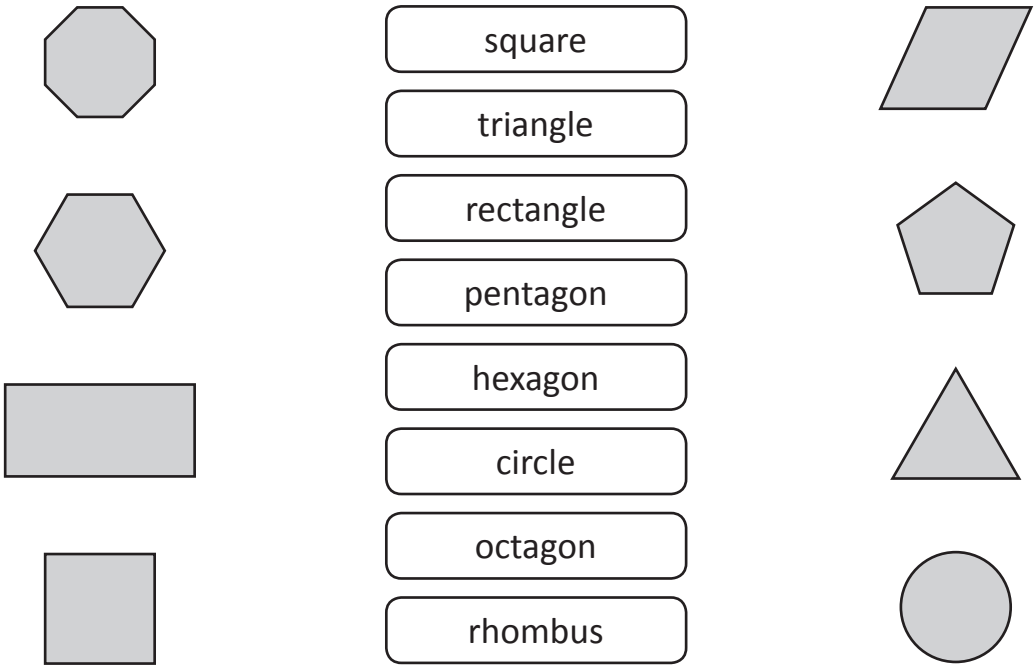


☐ right angles = ☐ turn

Investigating 2D shapes – properties of shapes

In this topic, we are looking at the properties of 2D shapes.

1 **Draw a line to match each shape to its name.**

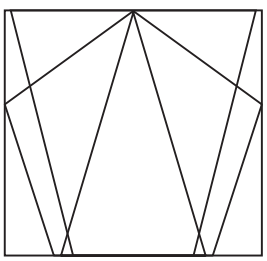


square
triangle
rectangle
pentagon
hexagon
circle
octagon
rhombus

2 **Complete this table for five of the shapes shown above.**

	Name	Number of sides	Number of vertices
a	rhombus		
b	pentagon		
c	triangle		
d	octagon		
e	hexagon		

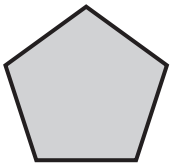
3 **Which shapes can you see in this diagram?**



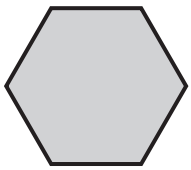
Investigating 2D shapes – properties of shapes

Let's look more closely at hexagons, pentagons and octagons.

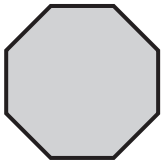
A pentagon is a shape with 5 sides.
'Penta' means 5.
A regular pentagon has 5 equal sides and 5 equal angles.



A hexagon is a shape with 6 sides.
'Hexa' means 6.
A regular hexagon has 6 equal sides and 6 equal angles.

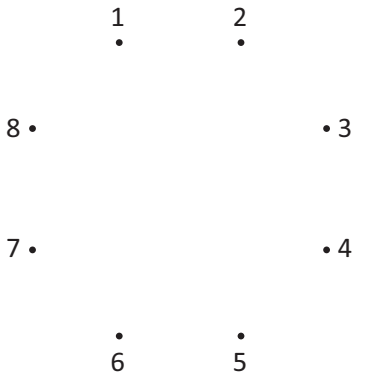


An octagon is a shape with 8 sides.
'Octa' means 8.
A regular octagon has 8 equal sides and 8 equal angles.



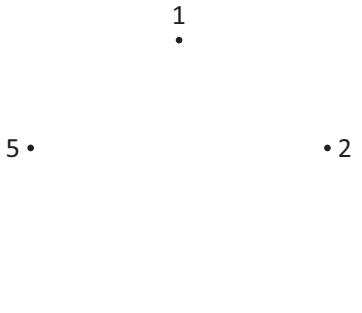
4 **Join the dots using a ruler and name each shape:**

a

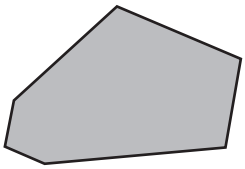


_____

b

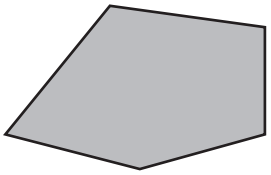


_____

5 

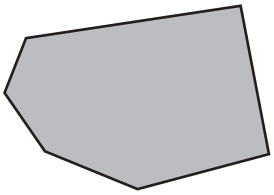
On the left is an irregular hexagon. It has 6 sides and 6 angles but its sides are all different lengths. Name each of the irregular shapes below:

a



irregular _____

b

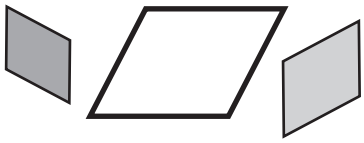


irregular _____

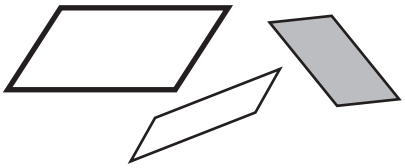
Investigating 2D shapes – rhombuses, parallelograms and trapeziums

Here are 3 special kinds of 4-sided shapes.

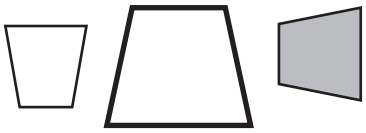
These are **rhombuses**.



These are **parallelograms**.



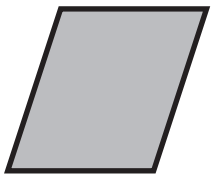
These are **trapeziums**.



What do they have in common? What are their differences? Let's look more closely at their lines and angles to find out more about them.

1 **Work with your partner to help these shapes answer some questions. Look at the shape blocks to help.**

a



Do I have any sets of parallel lines? If so, how many? ☐

Are ALL my sides the same lengths? ☐

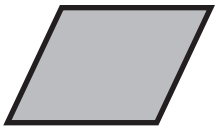
Do I have any right angles? ☐

Is there anything else you notice about me?

_____

.....

b



Do I have any sets of parallel lines? If so, how many? ☐

Are ALL my lines the same lengths? ☐

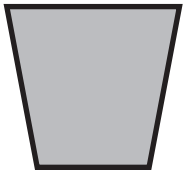
Do I have any right angles? ☐

Is there anything else you notice about me?

_____

.....

c



Do I have any sets of parallel lines? If so, how many? ☐

Are ALL my lines the same lengths? ☐

Do I have any right angles? ☐

Is there anything else you notice about me?

_____

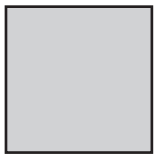
Investigating 2D shapes – rhombuses, parallelograms and trapeziums

2 **Draw a rhombus, a parallelogram and a trapezium**

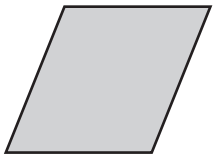
3 **Now draw them again, but turn them around and make them a different size. Label them.**

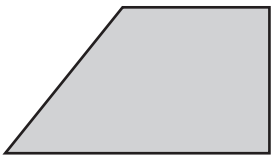
Investigating 2D shapes – quadrilaterals

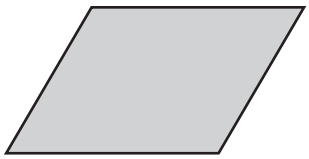
Quadrilaterals are shapes with 4 sides.


square


rectangle


rhombus


trapezium


parallelogram

1 **Which quadrilateral am I?**

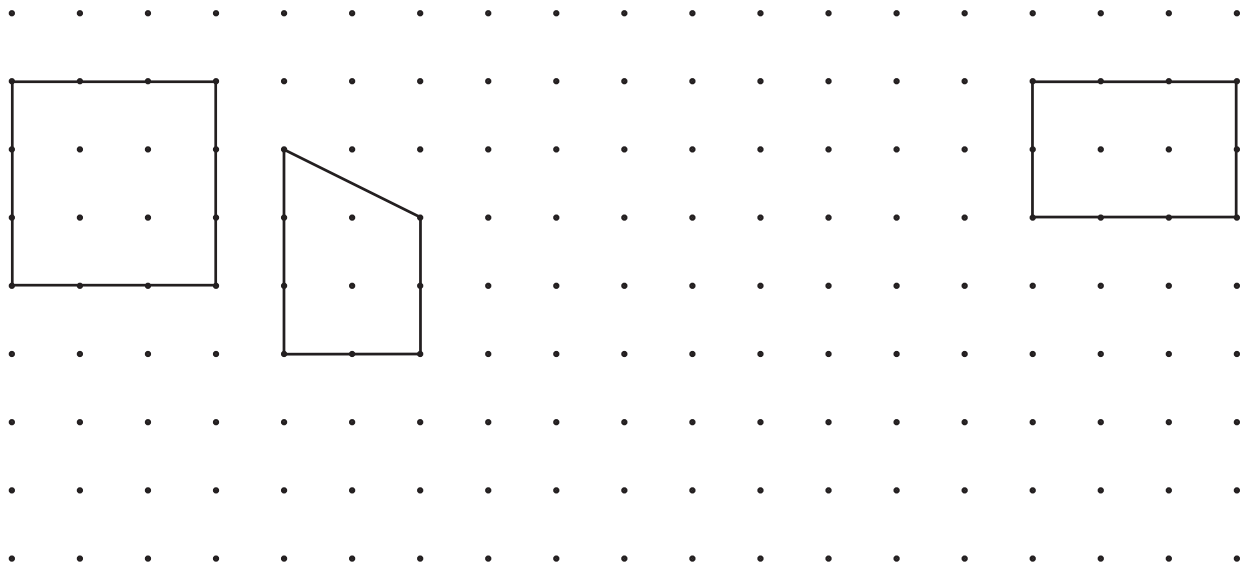
a My opposite sides are equal in length and all my angles are right angles. _____

b I have 4 sides that are all the same length with 2 different sized angles. _____

c I have 4 sides with only 1 pair of parallel sides. _____

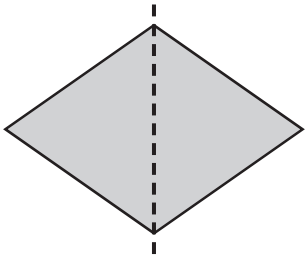
d I have 4 sides with 2 pairs of parallel sides and 2 different sized angles. _____

2 **Which two quadrilaterals are missing? Add them to the dot paper below:**

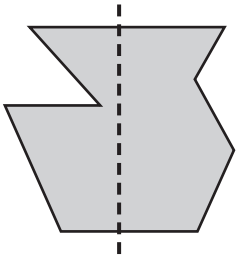


Investigating 2D shapes – symmetry and tessellation

An axis of symmetry is a line that divides something exactly in half. When one half of a shape or picture matches the other exactly, we say it's symmetrical.

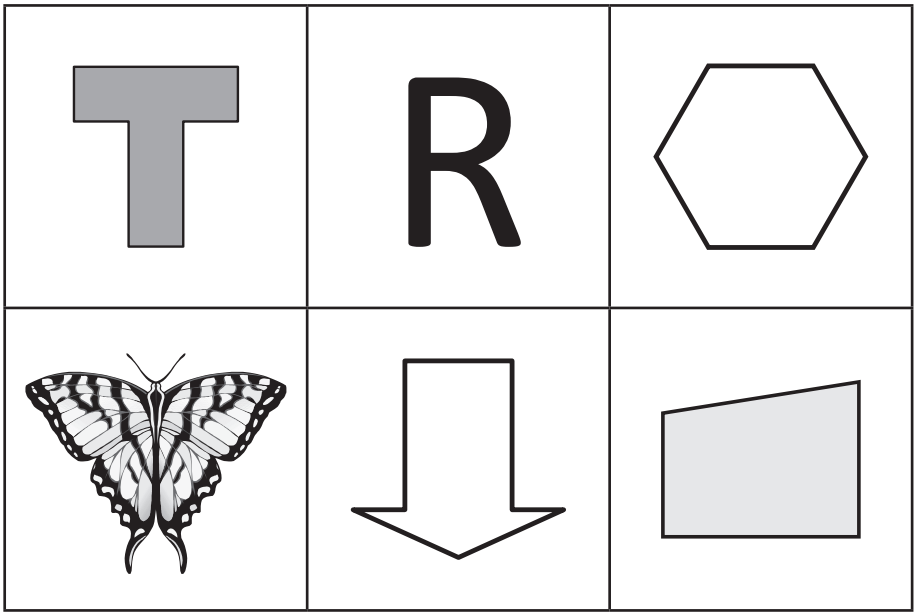


This shape is symmetrical.



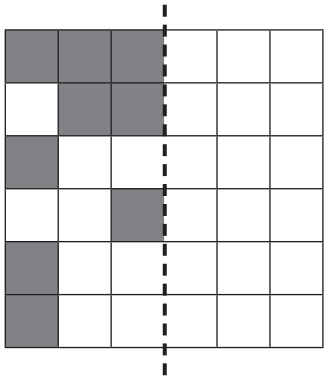
This shape is asymmetrical.

1 **Look carefully at each shape. For any that are symmetrical, draw in the line of symmetry.**

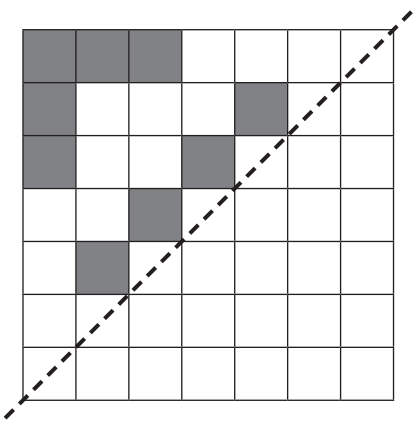


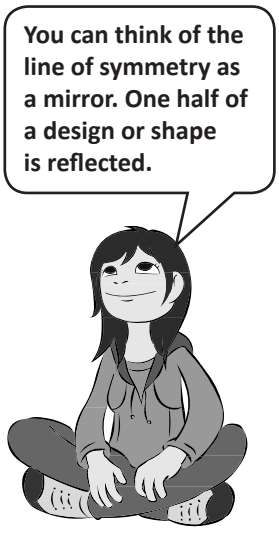
2 **Use the line of symmetry to complete each shape.**

a



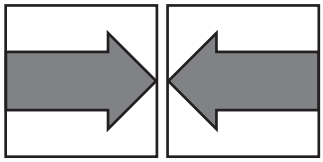
b



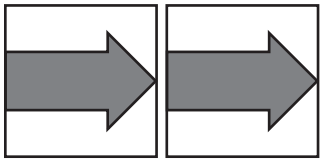


Investigating 2D shapes – symmetry and tessellation

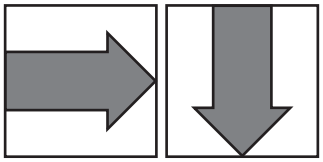
This tile demonstrates the movements of flip, slide and turn.



flip



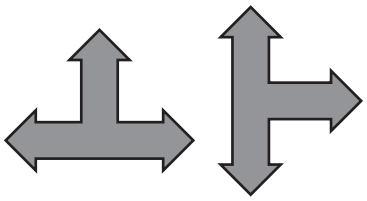
slide



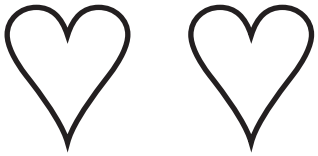
turn

3 **Look at each shape and write whether the movement is a flip, slide or turn.**

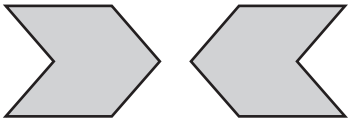
a



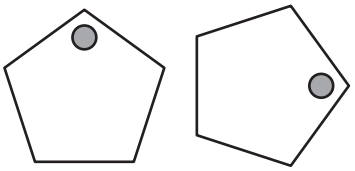
b



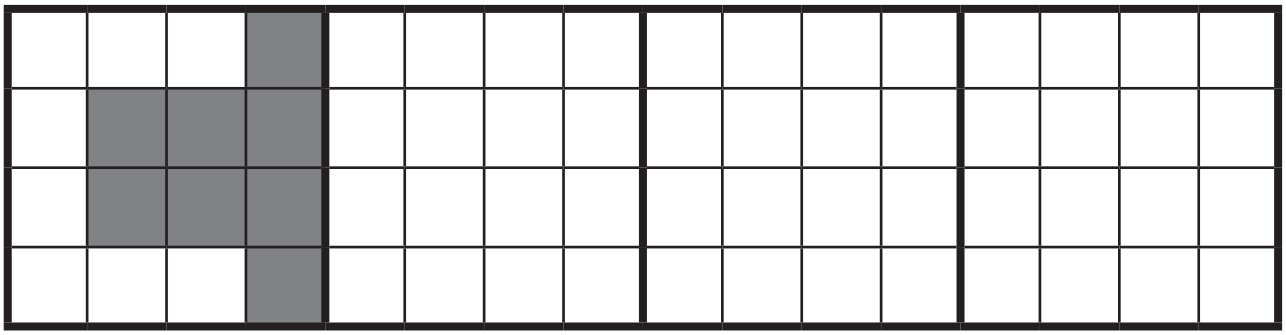
c



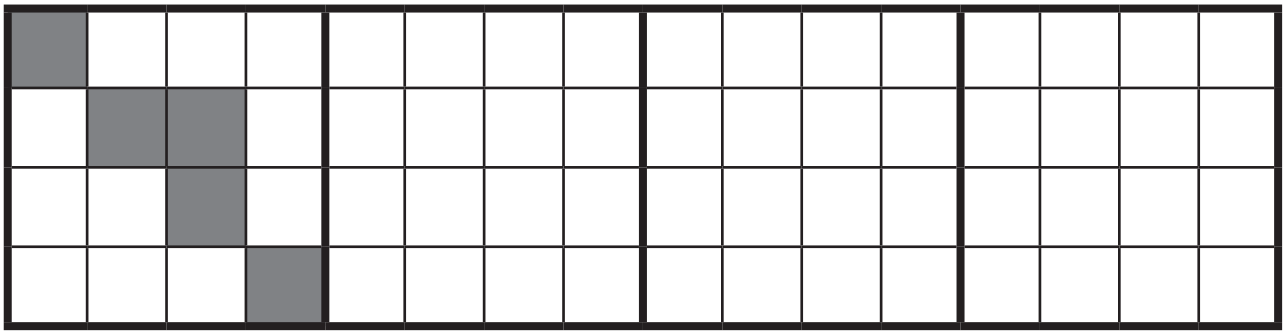
d



4 **Flip the design in each square to create a pattern along the grid.**



5 **Turn the design in each square to create a pattern along the grid.**

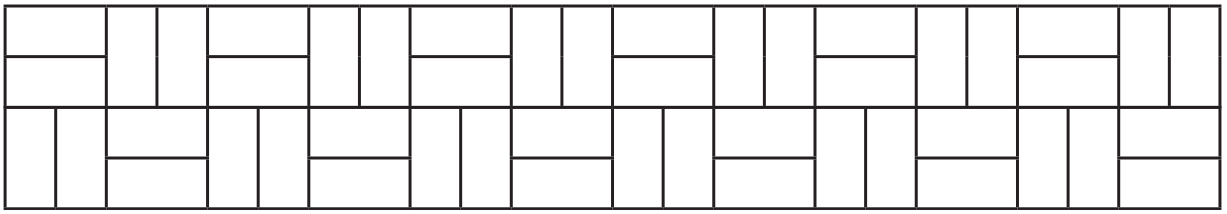


Investigating 2D shapes – symmetry and tessellation

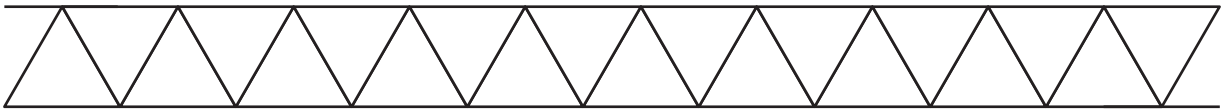
A tessellation is a pattern of 2D shapes with no gaps or spaces. Shapes can be flipped or turned so they fit together.

6 **Use four colours to shade each tessellation as a pattern.**

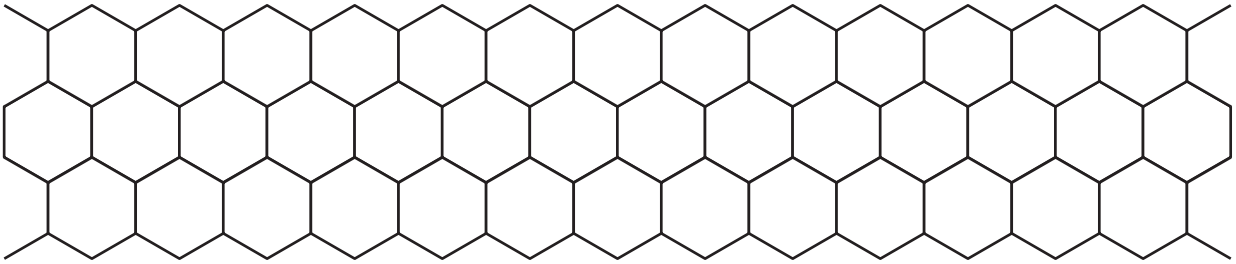
a



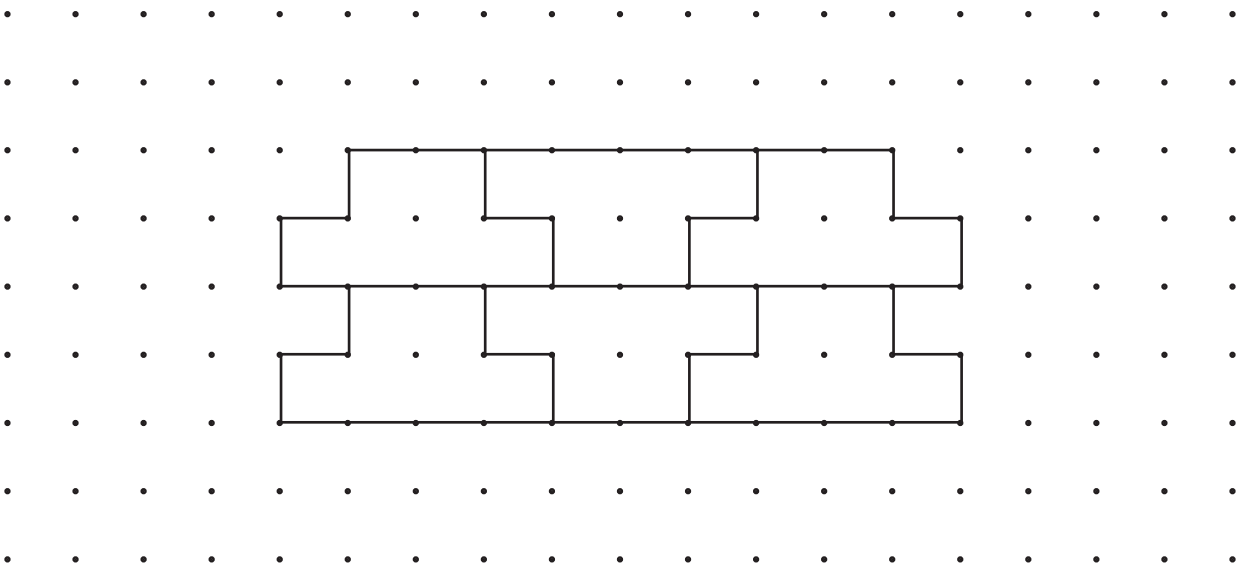
b



c



7 **Use a ruler to carefully continue this tessellation to the edges of the dot paper.**



Tangrams

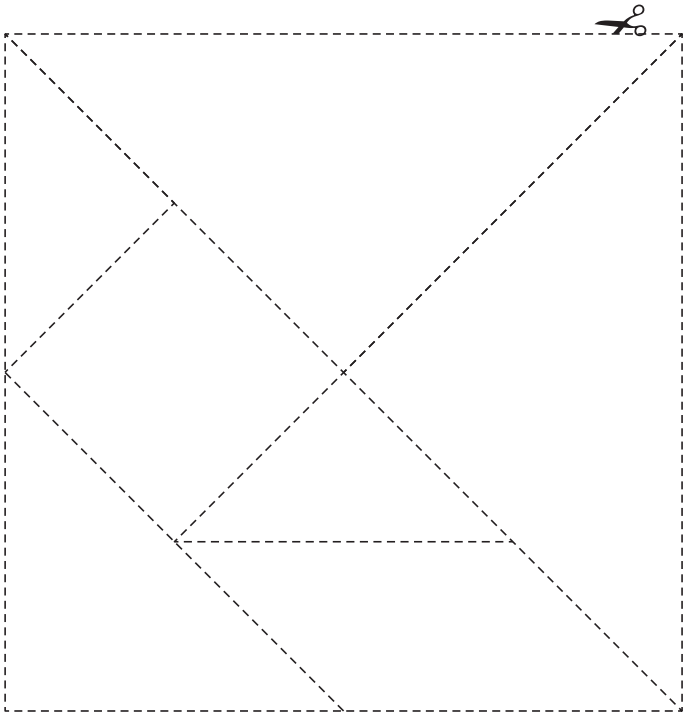
investigate

Getting ready

For this challenge, you will need to copy, colour and cut out the tangram pieces below.

copy

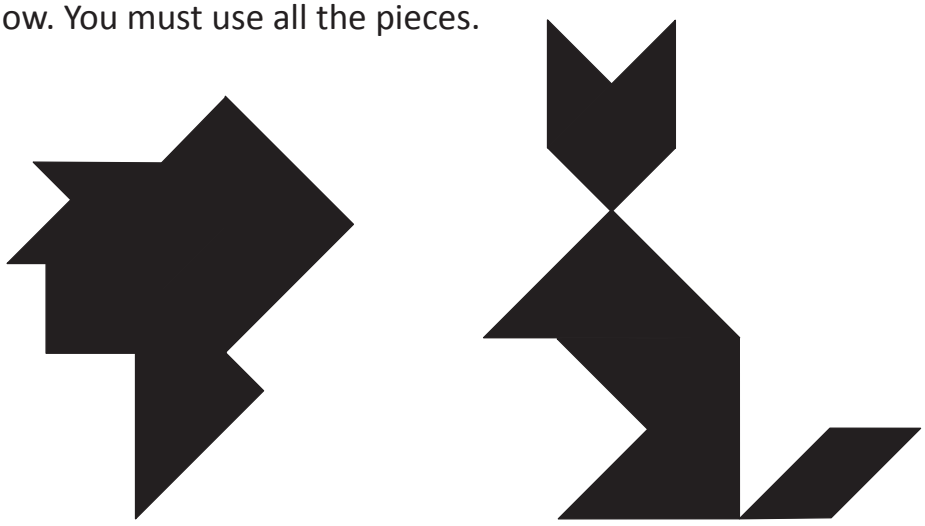
What to do



1 Practice using the pieces with these challenges:

- Make a square using three triangles.
- Make a parallelogram using two triangles.
- Make a large triangle using the square and two triangles.

2 Now see if you can make the designs below. You must use all the pieces.



Getting ready

For this challenge, you will need two orange, two black and two white cubes (or three colours of your own choice, as long as you have two cubes of each colour).

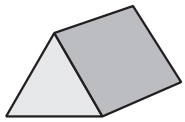
What to do

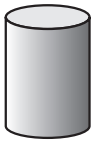
How many ways can you arrange the colours in a row so that the pattern is symmetrical? Use the cubes to decide on the symmetry and then record what you decide by shading each row.

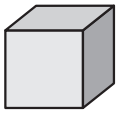
Investigating 3D shapes – properties of shapes

In this topic, we are looking at the properties of 3D shapes.

1 **Match the label to each 3D shape by connecting them with a line.**







cube

cylinder

cone

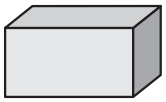
sphere

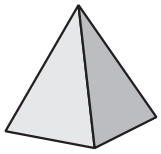
triangular prism

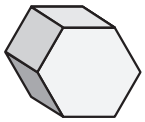
square-based pyramid

rectangular prism

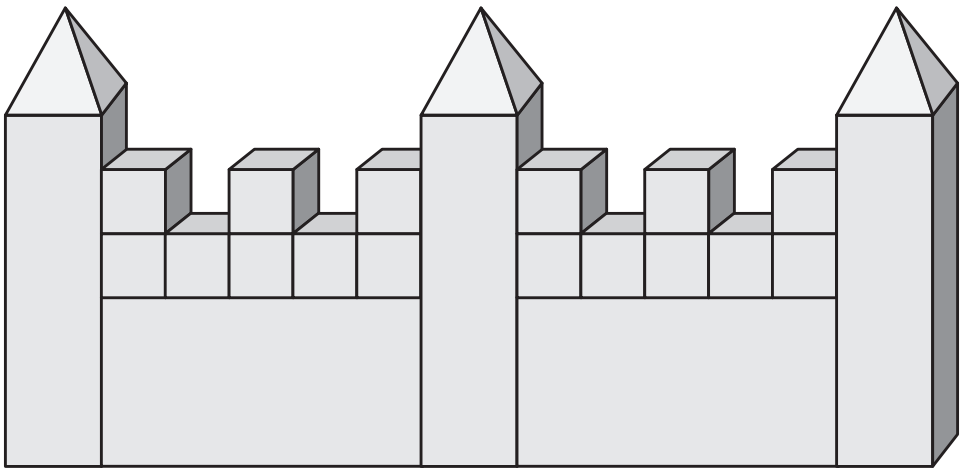
hexagonal prism







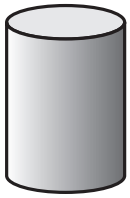
2 **Jess made a castle from some blocks. How many of each 3D solid can you see?**



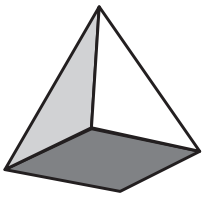
cubes ☐ rectangular prisms ☐ square pyramids ☐

Investigating 3D shapes – spheres, pyramids and cylinders

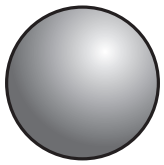
Let's look more closely at these solids:



cylinder



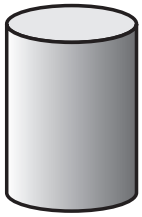
square-based pyramid



sphere

1 **Connect the labels to the part of each solid that it names:**

a

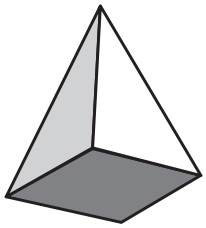


edge

flat face

curved face

b



vertex

edge

flat face

2 **Complete this table:**

	Name	Number of flat faces	Number of curved faces	Number of edges	Number of vertices
a	cylinder				
b	square-based pyramid				
c	sphere				

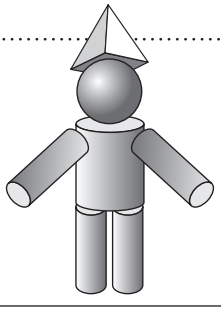
3 **Which shape has:**

a Only one curved face _____

b Five faces and no curved surfaces _____

c One curved face and two flat faces _____

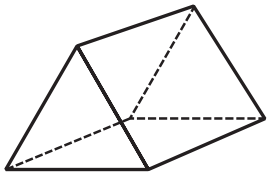
4 **Sean made this model. How many of each shape did he use?**



☐ cylinders ☐ square-based pyramid ☐ spheres

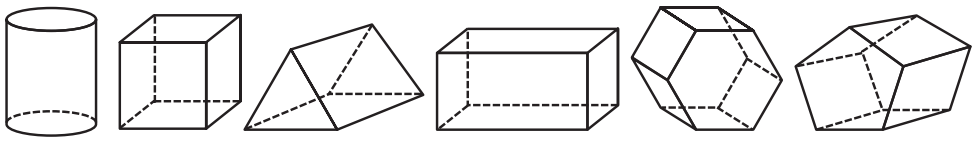
Investigating 3D shapes – prisms and pyramids

A prism is a 3D shape where the two opposite faces are the same shape and the other faces are rectangles.

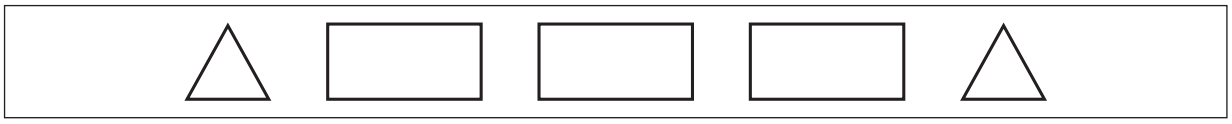


Here is a triangular prism. Its opposite faces are triangles and the other faces are rectangles.

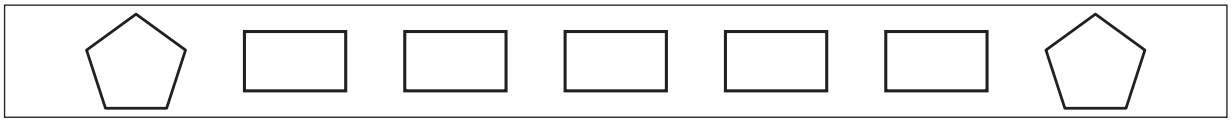
1 **Rachel painted each face of the solids below and then stamped each face in a row. Colour match each shape to its row of faces.**



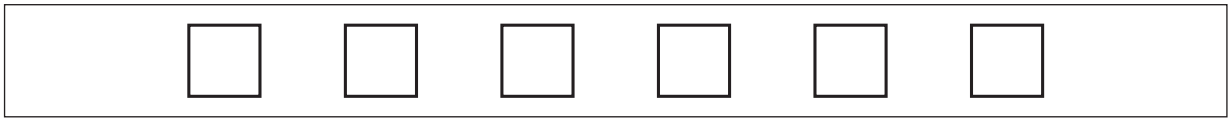
a



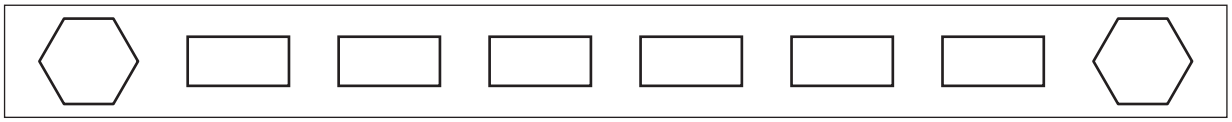
b



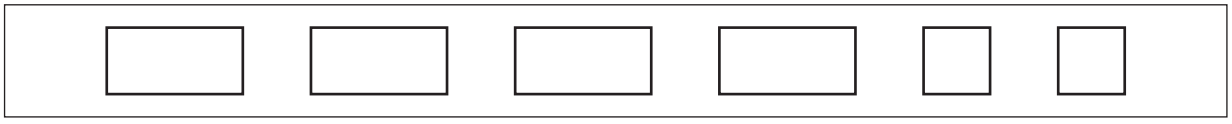
c



d



e

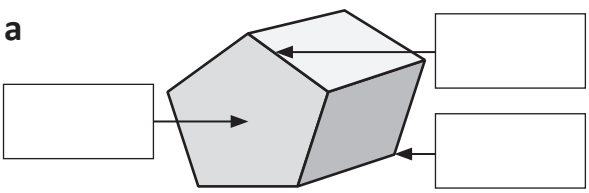


f

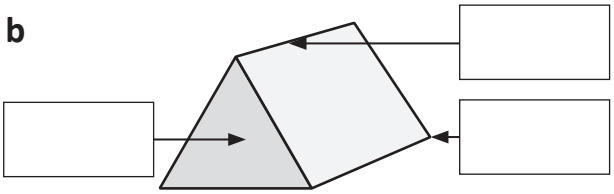
A face of a 3D shape is a flat surface. A vertex is where the edges meet or the furthest point from the base (apex).

2 **Use these labels on each shape below:** **face** **vertex** **edge**

a

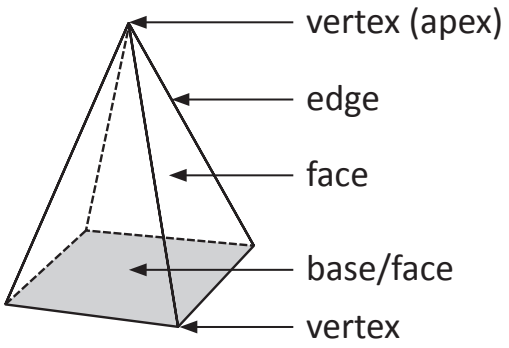


b

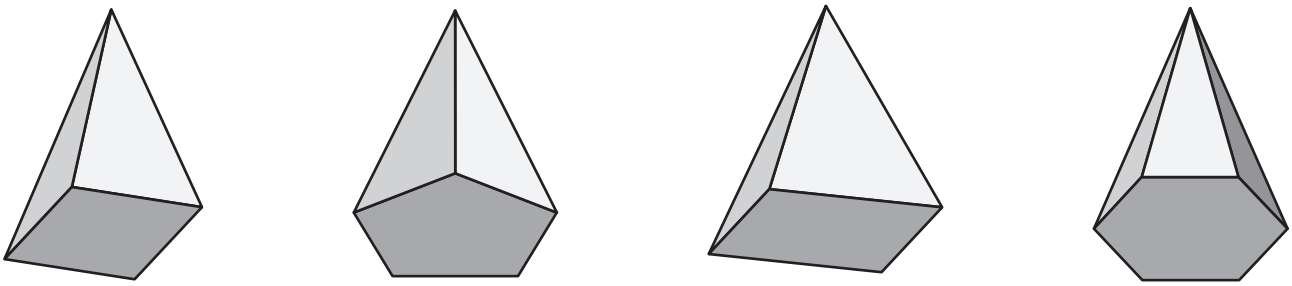


Investigating 3D shapes – prisms and pyramids

Pyramids are all named according to their base. This diagram shows the properties of a square pyramid.



3 **Name each pyramid by connecting the label with a line. Look carefully at the base of each pyramid.**



hexagonal pyramid

square-based pyramid

pentagonal pyramid

rectangular pyramid

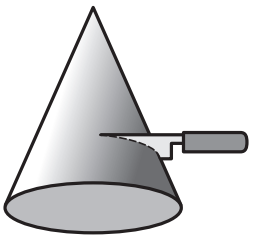
4 **Complete this table for each type of pyramid:**

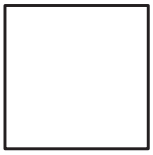
	Pyramid	Faces	Edges	Vertices
a	hexagonal pyramid			
b	pentagonal pyramid			
c	square-based pyramid			
d	rectangular pyramid			

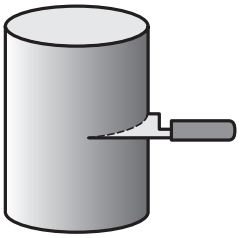
Investigating 3D shapes – cross sections

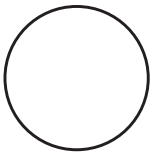
A cross section of a 3D shape is when you slice right through something.

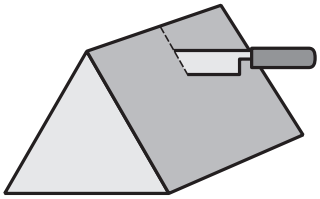
1 Each of these shapes represents the cross section of the solids below. Draw a line to match each shape to its cross section.

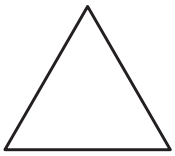


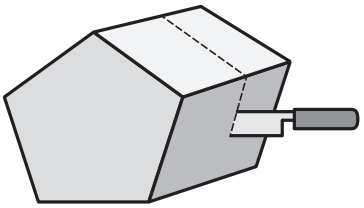


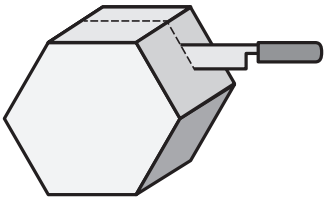


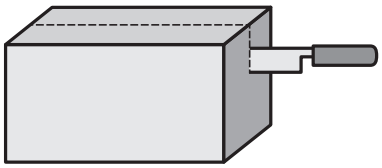


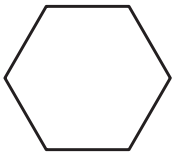


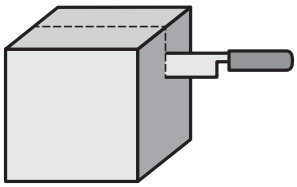


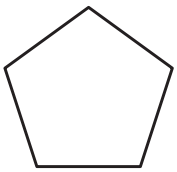


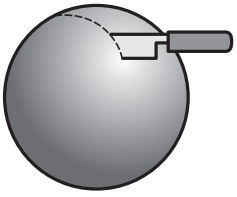






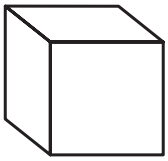


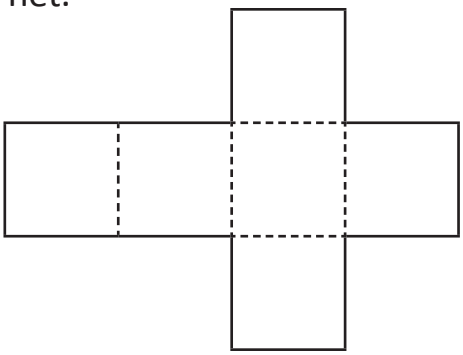




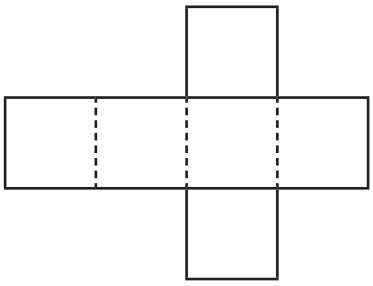
Investigating 3D shapes – nets

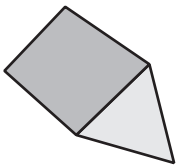
If we were to cut out a cardboard cube along the edges and flatten it, it would be a net.

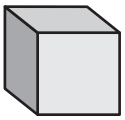


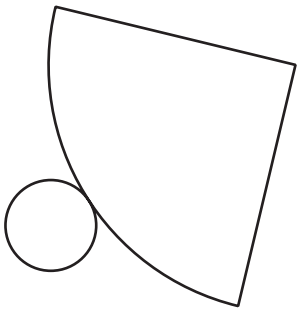


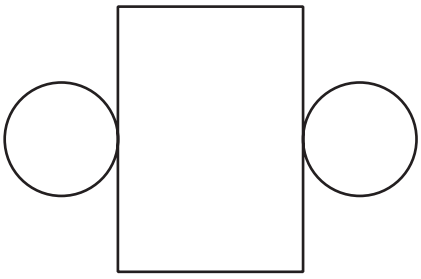
1 **Draw a line to match these 3D shapes with their nets below:**

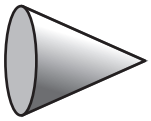


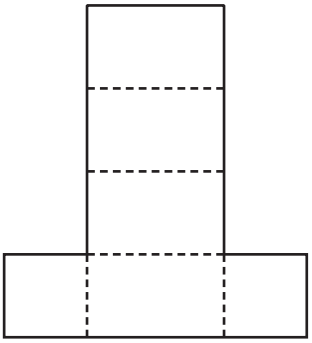


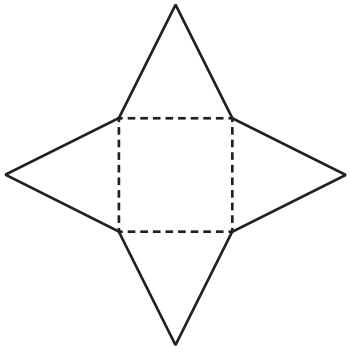


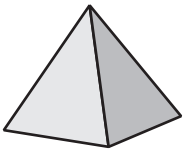


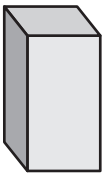


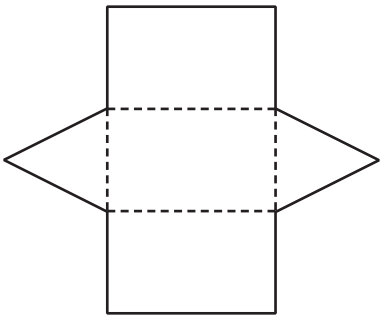






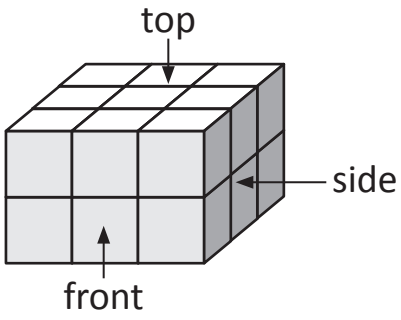






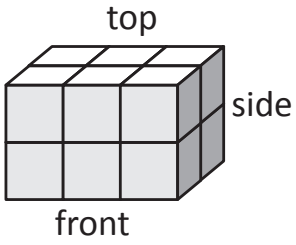
Investigating 3D shapes – different views

3D shapes look different depending on whether you look at them from the top view, side view or front view.

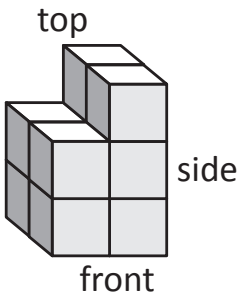


1 **Here are some 3D models made from cubes. Shade in the squares on each grid to show the top, front and side view for each one. The top view of the first model has been done for you.**

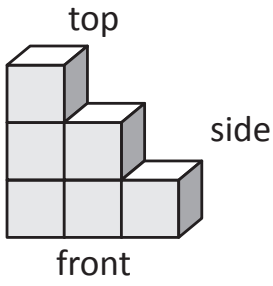
a



b



c



	a	b	c
Top View			
Front View			
Side View			

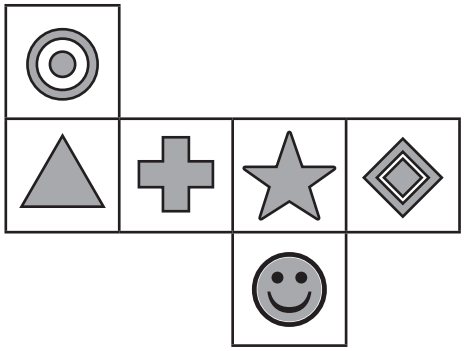
Net puzzle

solve

What to do

Each net below will fold to make a cube.

Puzzle 1



What symbol is opposite the star?
Draw it here:

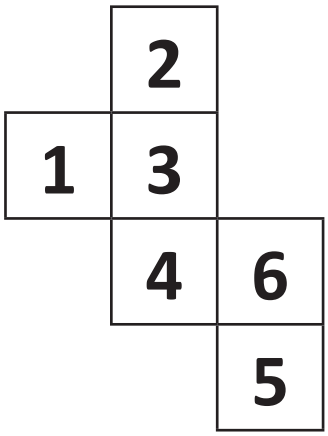
Puzzle 2

Work out which numbers are opposite.

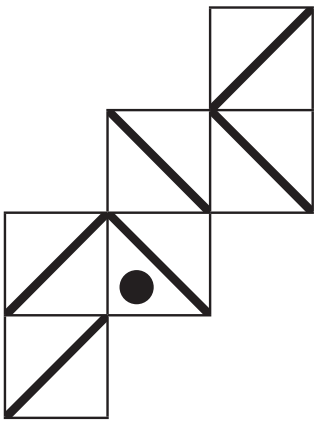
Opposite 1 is ☐

Opposite 2 is ☐

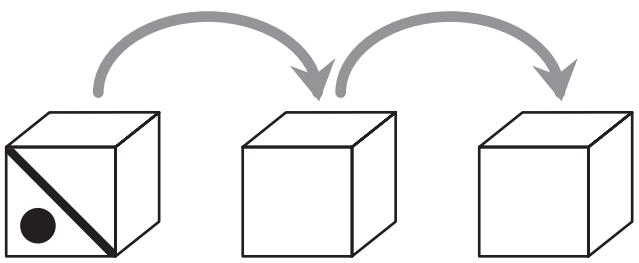
Opposite 3 is ☐



Puzzle 3

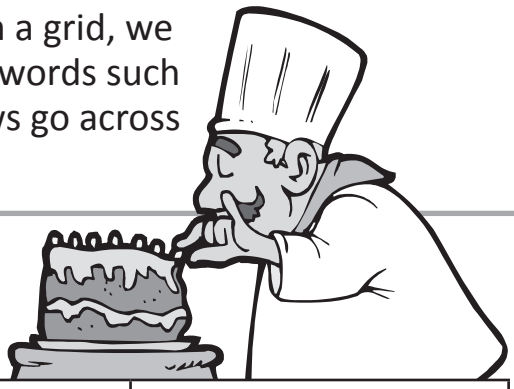


This net is folded into a cube and then the cube is rolled over twice. Show what this cube will look like each time that it is rolled over. You need to show what each face on each cube will look like. One face has been done for you.

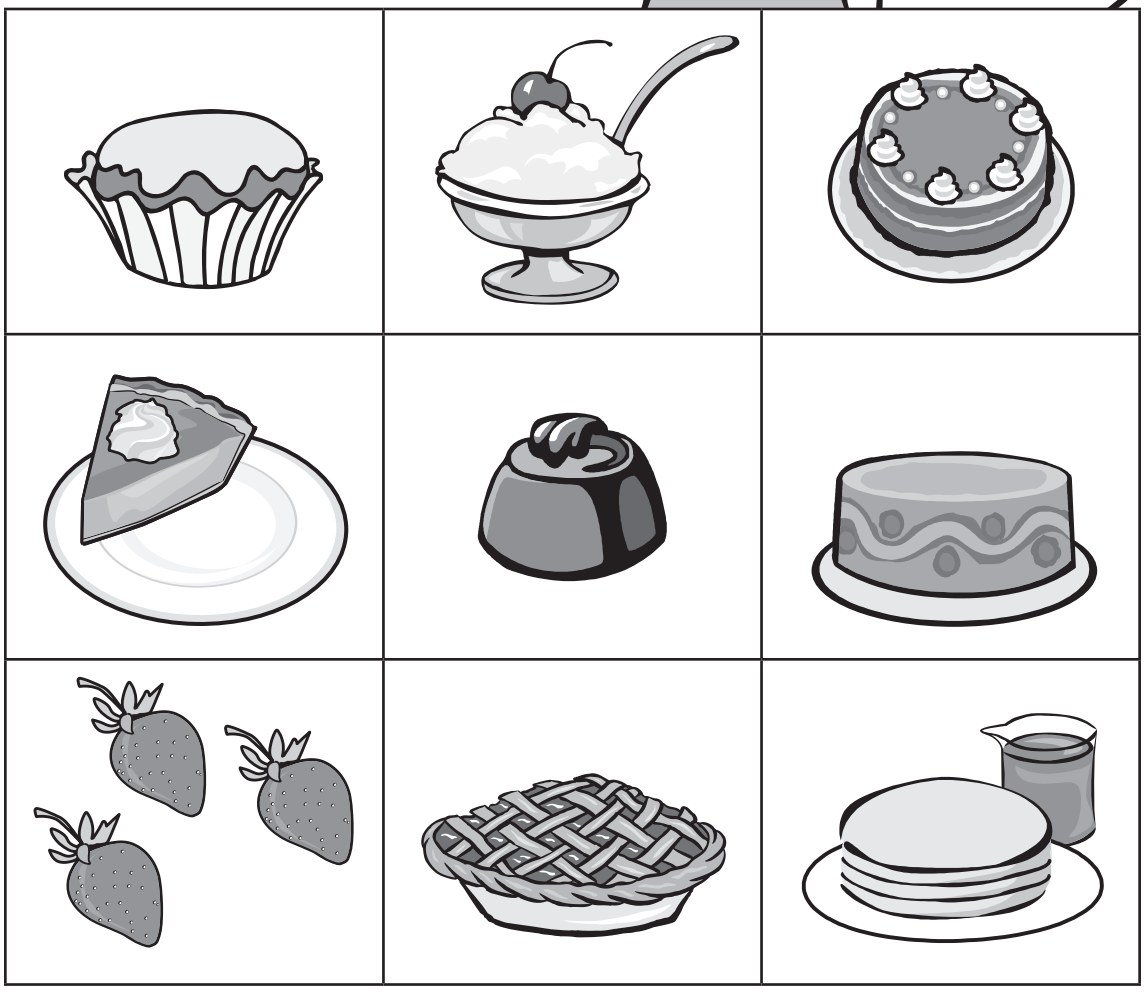


Position – describing position

When we describe the position of an object in a grid, we need to refer to the row and column. We use words such as left and right, top, middle and bottom. Rows go across and columns go up and down.



1 **Help Chef Claude by adding the finishing touches to these sweet treats.**



a	top row in the middle	Add some chocolate sprinkles.
b	middle row, last column	Add some candles.
c	bottom row, first column	Dip the strawberries in melted chocolate.
d	top row, first column	Add a cherry.
e	bottom row, last column	Pour some maple syrup on the pancakes.
f	middle row, first column	Add a scoop of ice cream.
g	bottom row, middle column	Add some whipped cream.

2 **A group of children are playing a game called Flickety Winks. In this game, they flick a counter twice and add the numbers that the counters land on to see who ends up with the largest score. Read the position of each throw and name the winner.**

1	6	7	3	11	10	2
10	2	8	12	3	9	2
5	9	11	4	12	21	23

	Counter 1	Counter 2	Total
Mel	top row, second from the left	bottom row, third from the right	
Jo	bottom row, third from the right	middle row, on the furthest right	
Hamish	middle row, second from the right	top row, fifth from the left	
Nina	bottom row, second from the right	top row, third from the left	

The winner was _____.

3 **Will played this game on his own and flicked three counters. He ended up with a total of 20. Describe the position of each counter:**

Counter 1:

Counter 2:

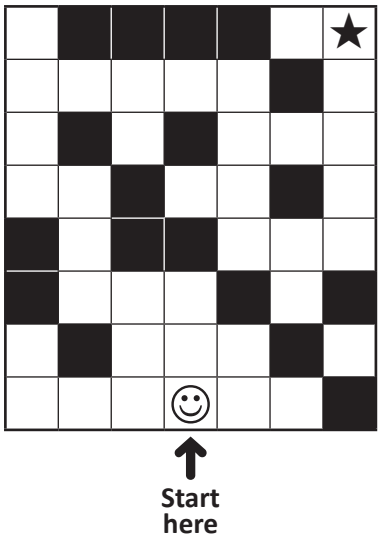
Counter 3:

Position – following directions

On this page, you will practise following the directions **up**, **down**, **left** and **right**.

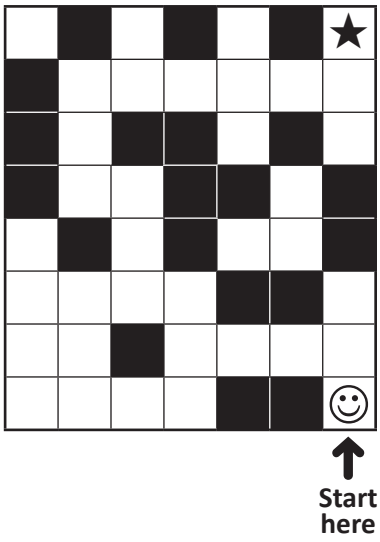
1 **Aisha is playing a game on her mobile phone where she has to move the snake from one end of the grid to the other without bumping into the black holes. Complete the directions that she used for each game. Start at the smiley face and finish at the star.**

a



2 up
2 left

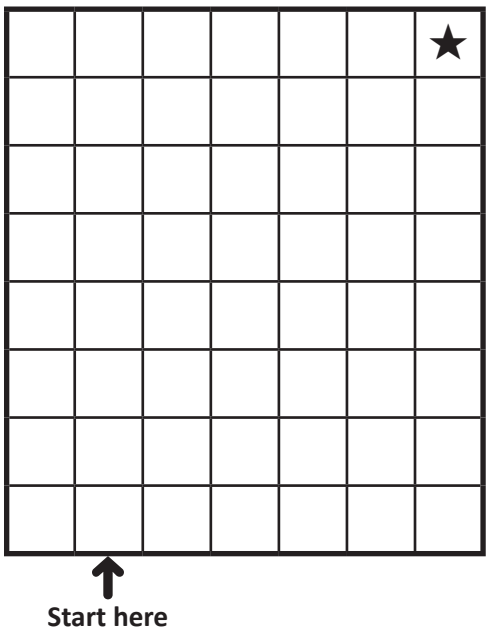
b



1 up
3 left

2 **Roll a die and move that number of spaces in any direction, colouring in as you go. You must move in a different direction each time. Start at the arrow.**

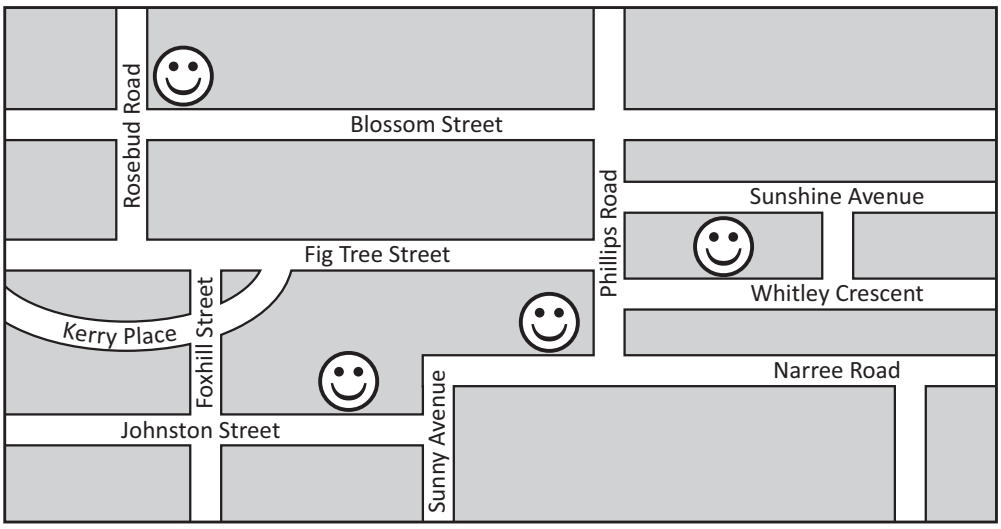
a Your aim is get to the star in the least number of moves. Compare your number of moves with someone near you.



b List the number of moves and the direction here:

Position – following directions

3 **A group of four friends live in the same neighbourhood. Each smiley face shows where someone lives.**



Colour the faces according to where each person lives:

a Libby lives on Whitley Crescent. Colour this face green.

b Max lives on Johnston Street. Colour this face blue.

c Emily lives on Narree Road. Colour this face red.

d Adam lives on the corner of Rosebud Road and Blossom Street. Colour this face orange.

4 **Look carefully at the map and answer the questions:**

a Adam crosses over Blossom Street, walks down Rosebud Road and turns left into Fig Tree Street. If he keeps walking he ends up on _____

b Emily walks to the end of her street and turns left into Sunny Avenue and then right into _____

c Max walks to the end of his street and turns left into Sunny Avenue, then right into Narree Road and left into Phillips Road and left again at Blossom Street. Who is he visiting? _____

d There is a shorter way he could have walked. Write him some directions below:

Position – grids and coordinates

Maps are often set up in a grid with letters and numbers down the sides. We use these letters and numbers to pinpoint a particular part of the map. Letters always go before numbers.

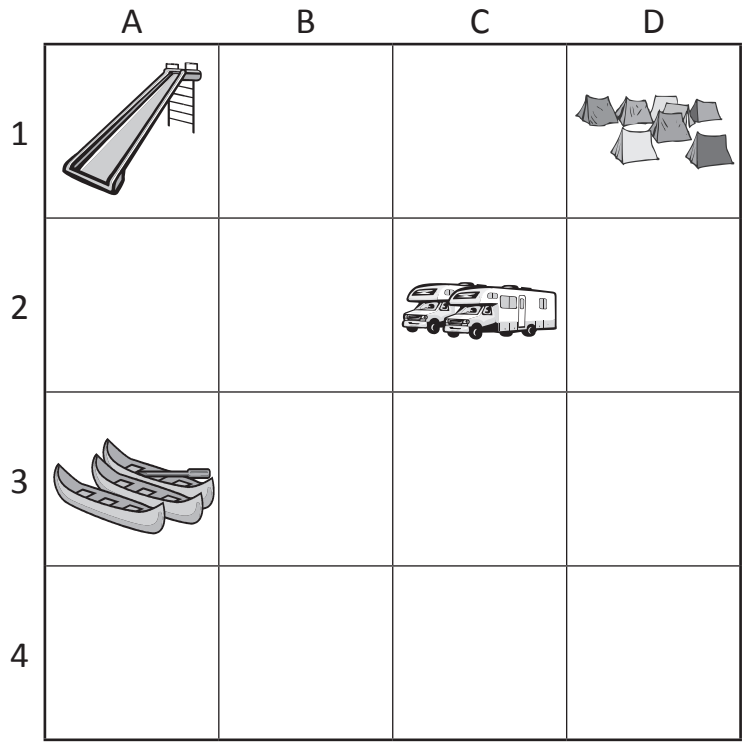
1 **Here is a map of a holiday camping ground. What is at:**

a A1 _____

b A3 _____

c C2 _____

d D1 _____



2 **This map is missing some places. Draw them in:**

a A lake that covers A4 and B4.

b Swings at A2.

c Jet skis at C4.

d A shed at D4.

e Trees that cover C3 and D3.

3 **Practise using grid coordinates by following these instructions:**

a Write an even number in A1.

b Write the first letter of your name in D2.

c In C4, draw a 2D shape that has more than 4 sides.

d In B2, write a number that is divisible by 3.

e In D4, write your age.

f Write the answer to 6 × 4 in C1.

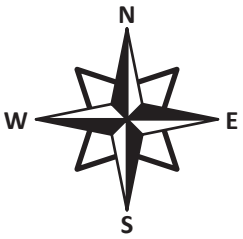
g List all the blank grid spaces. Remember that it is letter then number.

	A	B	C	D
1				
2				
3				
4				

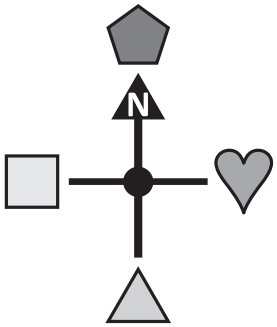
_____

Position – compass points

We can use a compass to help us with direction. There are four main points on a compass – north, south, east and west.



1 **What directions are the shapes from the circle?**



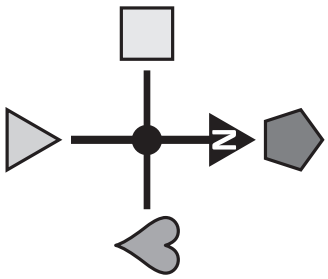
a The square is _____ of the circle.

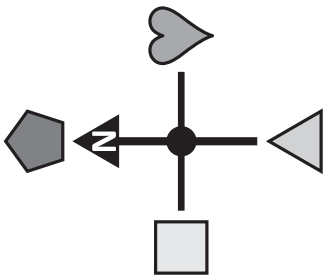
b The pentagon is _____ of the circle.

c The triangle is _____ of the circle.

d The heart is _____ of the circle.

2 **Sometimes north is not directly in front of us. Answer these questions. You will need to look carefully to see where north is.**





a Which shape is located west? ☐

b Which shape is located south? ☐

3 **If photo 1 was taken facing north, what direction was the person facing in photo 2?**

Photo 1

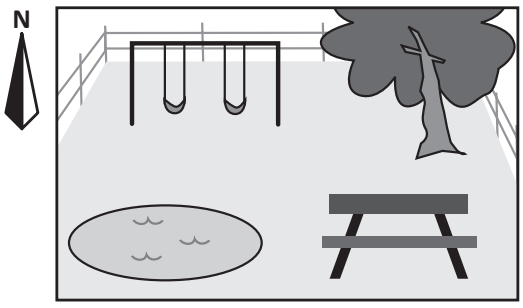
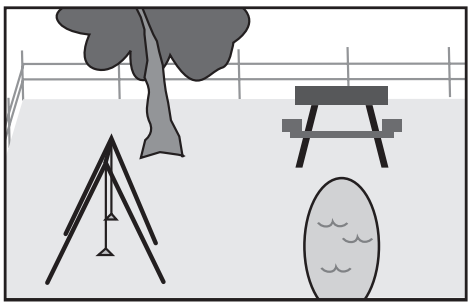


Photo 2



☐

Hit the points

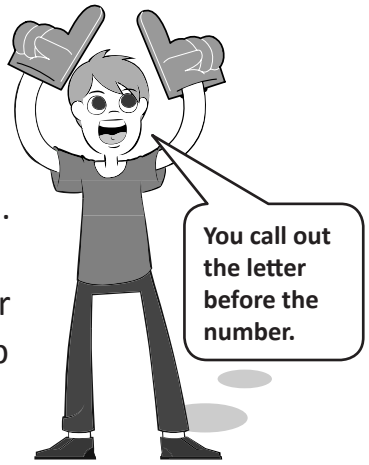
apply

Getting ready

This is a game for two players. For this game, each player will need their own copy of this page. Cut out the numbers and black squares at the bottom of this page.

What to do

Each player places the numbers and black squares on their grid without the other player seeing. Take turns to find each other's numbers by calling out coordinates. The aim of the game is to find out where all the numbers are before the other player does. The numbers that are found make up the score. If you call out a coordinate that is a black square, then you miss a turn.



	A	B	C	D	E	F	G	H	I	J	K
6											
5											
4											
3											
2											
1